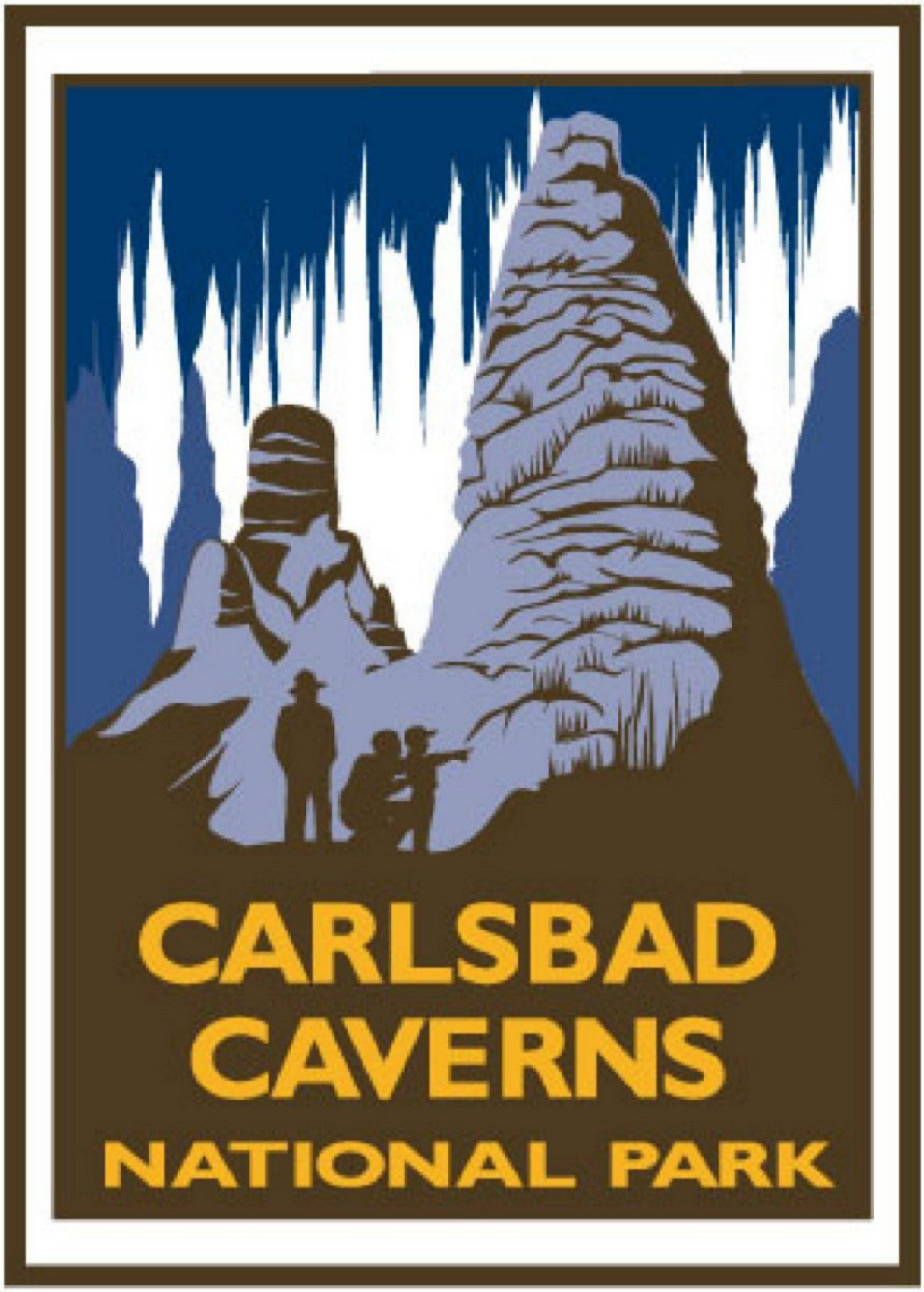
Life Science

A curriculum and activity guide for Carlsbad Caverns National Park

Middle School Ecology



CONTENT STANDARDS WITH BENCHMARKS

Science

Unifying Concepts and Processes

CONTENT STANDARD 1:
Students will understand science concepts of order and organization.

SC1-E1
Students will apply information about the predictability and organization of the universe and its subsystems.

SC1-E2
Students will apply prediction to scientific problems and events.

CONTENT STANDARD 2:
Students will use evidence, models, and explanations to explore the physical world.

SC2-E1
Students will identify and organize evidence needed to predict changes in natural and artificial systems.

SC2-E2
Students will organize phenomena into hypotheses, models, laws, theories, principles, and paradigms.

SC2-E3
Students will design and develop models.

CONTENT STANDARD 3:
Students will use form and function to organize and understand the physical world.

SC3-E1
Students will explain function by referring to form and explain form by referring to function.

CONTENT STANDARD 4:
Students will understand the physical world through the concepts of change, equilibrium, and measurement.

SC4-E1
Students will illustrate that constancy and change are properties of objects and processes.

SC4-E2
Students will illustrate that energy and matter can be transformed and changed but the sum remains the same.

SC4-E3
Students will use elementary scientific devices to measure objects and simple phenomena.
SC4-E4
Students will employ mathematics to quantify properties of objects and phenomena.

SC4-E5
Students will relate the contributions of external and internal forces to change in the form and function of objects, organisms, and natural systems.

Science as Inquiry

CONTENT STANDARD 5:
Students will acquire the abilities to do scientific inquiry.

SC5-E1
Students will use the scientific method within the classroom and school environment.

SC5-E2
Students will employ equipment, tools, a variety of techniques, and information sources to gather, analyze, and interpret data.

SC5-E3
Students will explain that scientific theories emphasize evidence, have logically consistent arguments, and use scientific principles, models, and theories. Well-accepted scientific theories are formulations of apparent relationships or underlying principles of certain observed phenomena that have been verified to a very high degree.

CONTENT STANDARD 6:
Students will understand the process of scientific inquiry.

SC6-E1
Students will use different kinds of methods, including observation, experiments, and theoretical and mathematical models to answer a variety of scientific questions.

SC6-E2
Students will use their own understanding of science to guide their scientific investigations.

SC6-E3
Students will use criteria for sound scientific investigations to verify the truth of the results of their own and others' investigations.

SC6-E4
Students will choose appropriate methods and analytic techniques for specific science problems and investigations.

SC6-E5
Students will use technology and scientific methods to gather evidence to enhance the accuracy of their findings.

SC6-E6
Students will describe the results of investigations with teachers, peers, parents, and others.

SC6-E7
Students will explain that scientific investigations can result in new ideas, objects, methods, techniques, and procedures for investigation.

SC6-E8
Students will explain that in areas where there is not a great deal of experimental or observational evidence, it is typical for scientists to differ with one another about the theory, hypothesis, or evidence being investigated.

Physical Science

CONTENT STANDARD 7:
Students will know and understand the properties of matter.

SC7-E1
Students will identify the characteristic properties of elements and compounds such as density, boiling point, and solubility.

SC7-E2
Students will explain that the characteristic properties of an element or compound are independent of the amount (size) of the sample.

SC7-E3
Students will discriminate between elements based on the characteristic ways in which they react with other elements to form compounds that are different substances with unique characteristic properties.

CONTENT STANDARD 8:
Students will know and understand the properties of fields, forces, and motion.

SC8-E1
Students will explain that when an object is not being subjected to a force, the object will continue to move at a constant speed and in a straight line.

SC8-E2
Students will describe quantitatively how an object's position, speed, and direction explain motion.

SC8-E3
Students will compare and contrast gravity to other forces in the world and universe.

CONTENT STANDARD 9:
Students will know and understand the concepts of energy and the transformation of energy.

SC9-E1
Students will apply knowledge about energy and energy transformation to science problems.

SC9-E2
Students will explain how chemical reactions can take place in time periods ranging from less than a second to millions of years.

SC9-E3
Students will explain how chemical reactions involve concentration, pressure, temperature, and catalysts.

Life Science

CONTENT STANDARD 10:
Students will know and understand the characteristics that are the basis for classifying organisms.

SC10-E1
Students will use information about living things including:

- The roles of structure and function as complementary in the organization of living systems.
- Cells as the fundamental unit of life.
- The functions of cells which sustain life.
- Cell division.
- The use of nutrients by cells.
- The role of heredity and environment in the characteristics of individual organisms.
- That small genetic differences between offspring and parents may accumulate in succeeding generations and may or may not be advantageous for the species.
- Disease as a breakdown in the structures or function of an organism.

SC10-E2
Students will categorize organisms according to reproductive and other characteristics.

CONTENT STANDARD 11:
Students will know and understand the synergy among organisms and the environments of organisms.

SC11-E1
Students will distinguish among organisms based on the way an organism regulates its internal environment in relation to changes in its external environment.

SC11-E2
Students will describe how organisms obtain and use resources, grow, reproduce, and maintain a stable internal environment while living in a constantly changing external environment.

SC11-E3
Students will predict behavior in relation to changes in an organism's internal and external environments.

SC11-E4
Students will use knowledge of population characteristics to distinguish specific populations.

SC11-E5
Students will categorize organisms based on the function they serve within their ecosystem.

SC11-E6
Students will examine the impact humans have had on other species and natural systems over time.

SC11-E7
Students will illustrate the impact that overpopulation might have on various regions of the world.

SC11-E8
Students will analyze consumption of nonrenewable resources based on population factors (birth rate, death rate, and density).

SC11-E9
Students will illustrate the role of personal control of basic needs on health outcomes.

SC11-E10
Students will model responsible health behaviors for peers and others.

SC11-E11
Students will demonstrate the impact of nutrition and exercise on personal health.

Earth and Space Science

CONTENT STANDARD 12:
Students will know and understand properties of earth science.

SC12-E1
Students will explain how Earth's materials can be transformed from one state to another.

SC12-E2
Students will experiment with the uses of Earth's materials as resources.

SC12-E3
Students will model natural processes that shape the Earth's surface.

SC12-E4
Students will observe, measure, and record weather changes that occur daily.

SC12-E5
Students will explain how fossils are formed and how fossils provide evidence of the complexity and diversity of life over time.

SC12-E6
Students will use a rectilinear coordinate system such as latitude and longitude to locate points on the surface of Earth.

SC12-E7
Students will describe the interaction between the Earth's lithosphere, hydrosphere, atmosphere, and biosphere.

CONTENT STANDARD 13:
Students will know and understand basic concepts of cosmology.

SC13-E1
Students will model the predictable patterns of the sun and planets in the solar system.

SC13-E2
Students will describe the elements of the universe including stars, galaxies, dust clouds, and nebulae.

SC13-E3
Students will explain various scientific theories for the origin of the universe.

SC13-E4
Students will explain how instruments and vehicles are used for space exploration work.

Technology and the History of Science

CONTENT STANDARD 14:
Students will know and understand the differences between the interactions of science and technology.

SC14-E1
Students will design and conduct experiments that distinguish between natural and artificial objects and materials.

SC14-E2
Students will demonstrate trade-offs in safety, cost, efficiency, and appearance related to technological solutions provided through science.

SC14-E3
Students will compare and contrast a variety of scientific and technological solutions to problems.

SC14-E4
Students will examine the role of technology, particularly computers and other electronic advances, in the advancement of science.

CONTENT STANDARD 15:
Students will know and understand the impact between science and technology in society.

SC15-E1
Students will illustrate the impact that work settings have on scientific investigations.

SC15-E2
Students will demonstrate how the direction for scientific investigations is related to social issues and challenges.

SC15-E3
Students will explain how the benefits of science and technology are enjoyed by some groups and not by other groups.

SC15-E4
Students will compare and contrast the science contributions of people with diverse interests, talents, qualities, and motivations from a variety of social and ethnic backgrounds.

SC15-E5
Students will predict new areas of scientific inquiry based on previous research.

SC15-E6
Students will analyze the impact of culture, gender, and other factors on an individual's choice of science as a career.

SC15-E7
Students will differentiate between ethical and unethical scientific practices and research.

Science in Personal, Social and Environmental Perspectives

CONTENT STANDARD 16:
Students will know and understand the relationship between natural hazards and environmental risks for organisms.

SC16-E1
Students will analyze environmental risks for personal and social costs.

SC16-E2
Students will determine options for reducing and eliminating environmental risks and for coping with natural catastrophic events.

SC16-E3
Students will predict the human and financial costs of slow natural events such as drought and rapid natural events such as earthquakes.

SC16-E4
Students will develop models for prevention of substance abuse including tobacco, alcohol, and other drugs, and to reduce the associated environmental risks.

Ecology Glossary

A

Abiotic factors are non-living parts of an ecosystem.

Adaptation a behavior, physical feature, or other characteristic that helps an animal survive and make the most of its habitat; the way any living thing is fitted to the life it leads.

Algal bloom is a consequence of eutrophication. Masses of blue-green algae choke the life out of a lake or river by depriving it of much needed oxygen. Under extreme conditions this can leave the water completely devoid of fish.

Alluvial fan a fan-shaped deposit of gravel, sand, and silt that forms where a stream flows into a plain and slows down, dropping its load.

Aquifer rock layers that contain water and will release its appreciable quantities into wells or springs.

Arch an alcove formed from erosion perched at the edge of a slick-rocked bowl.

Arid dry.

Arroyo a deep gully cut by an intermittent stream.

B

Biological parameters refers to organisms supported in the water such as bacteria, plankton, and fish.

Biome an area that has a certain kind of climate and a certain kind of community of plants and animals.

Biotic factors the living parts of an ecosystem.

Burrow a hole or tunnel dug in the ground by an animal for habitat or refuge.

Butte a hill that rises abruptly from the surrounding area; it has sloping sides and a flat top.

C

Canyon a narrow chasm with steep cliff sides.

Carnivores secondary or higher consumer in a food chain that therefore eats other animals.

Chemical parameters refer to the chemical make-up of the water such as the amount of dissolved oxygen, phosphate, and nitrate.

Clay soil contains fine particles, and is heavy, cool, and damp.

Columns are left after an arch changes or falls, leaving a layer of more resistant rock caps.

Combustion a chemical change accompanied by heat and light.

Community a group of plants and animals that lives in the same habitat.

Commensalism an interaction between two living things where one species benefits from the relationship and the other is not affected.

Community all populations in a given area.

Competition an interaction among living things where two populations compete for the same resources and territory.

Conservation a scientific discipline that seeks to understand the effects of human activities on species, communities, and ecosystems and to develop practical

approaches to preventing the extinction of species and the destruction of ecosystems.

Consumer animals that cannot make their own food, but must eat plants and/or other animals.

Cryptobiotic soils a living soil crust dominated by cyanobacteria, soil lichens, mosses, green algae, microfungi, and bacteria, the knobby black crusts are extraordinarily well-developed, and may represents 70 to 80 percent of the living ground cover. These crusts play an important role in the ecosystems in which they occur. They are found in the Colorado Plateau (Utah, Arizona, Colorado and New Mexico).

Cultural eutrophication is water pollution caused by excessive plant nutrients.

D

Decomposer organisms that feed on the dead bodies of other organisms, breaking them down into simpler substances.

Deforestation to clear away all the trees.

Dehydrated to remove or lose water.

Dendrochronology the method of dating events and conditions based on the number, width, and density of growth rings in old trees.

Deposition is a natural process occurring when materials are carried from one place and deposited in another by such forces as wind, water, and ice.

Desert an area that receives less than 10 inches of rainfall a year and has a very high rate of evaporation.

Desert varnish is a dark coating on rocks found in arid regions. The coating is composed predominantly of fine-grained minerals. Desert varnish is formed by colonies of microscopic bacteria living on the rock surface for thousands of years.

Detritivores an organism that feeds on large bits of dead and/or decaying organic matter. Decomposers use what detritivores leave behind.

Drought a long period of low rainfall.

Dune a ridge or hill of wind-blown sand.

Durable surface rock, sand, and gravel; these surfaces are highly durable and can tolerate repeated trampling and scuffing.

E

Ecology the study of how plants and animals interact with each other and their environments.

Ecosystem all the living organisms in a given area as well as their physical environment—usually made up of many complex interactions.

Environment the sum of all the surroundings affecting something's development and survival.

Erosion wearing away the land by physical methods such as rubbing and scraping, and carrying away the eroded materials, such as rock particles.

Eutrophication is the process by which lakes gradually age and become less productive.

Evaporation when a liquid turns into vapor or gas.

F

Fire a rapid persistent chemical change that releases heat and light and is accompanied by flames.

Flash flood when water run off overflows the bank of rivers and streams, caused usually by heavy rainfall in a small area.

Forest a large area thickly covered with trees and plants.

Fuel something consumed to produce energy.

G

Grassland a large open area of grass, such as a meadow or prairie.

Groundwater water that fills the spaces between rocks and soil particles underground.

H

Habitat the place where an organism lives.

Hardpans a layer of hard subsoil or clay; caliche.

Herbivores an animal that feeds chiefly on plants.

Humidity the amount of moisture in the air.

K

Karst a type of topography that is formed in limestone, gypsum, and other soluble rocks primarily by dissolution; are characterized by sinkholes, caves, and underground drainage.

L

Leaching the process by which materials on or in soil are dissolved and carried by water seeping through the soil.

Limiting factors are those factors that particularly determine whether an organism lives in an area.

Limnology the study of inland fresh water systems.

Loam contains sand and clay.

M

Mesa a flat-topped elevation with steep sides.

Microhabitat a small area where an organism lives that has different conditions from another small area that might be right next door.

Mutualism an interaction among living things where both species benefit from the relationship.

N

Niche an organism's way of life, also considered to be an organism's occupation.

Nonpoint pollution pollution that doesn't come from a single, identifiable source; includes materials that wash off streets, lawns, farms, and other surfaces.

O

Ocean the body of salt water that covers much of the Earth's surface.

Overcrowding when too many organisms try to live in one area at one time and use up all the natural resources.

Oxidation is the chemical reaction by which oxygen combines chemically with the elements of a burning substance.

P

pH a measure of the acidity or alkalinity of a solution.

Parasitism an interaction among living things where one species benefits at the expense of another.

Peat soil contains decayed plants and dead plant material.

Photosynthesis the process of using the sun's energy to turn carbon dioxide and water into sugar.

Physical parameters are conditions that refer to water temperature, stream velocity, and turbidity (clarity).

Playa a flat area at the bottom of a desert basin, sometimes temporarily covered with water.

Point pollution pollution that comes from a particular source, such as from a factory or sewage treatment plant.

Pollinate to fertilize by transferring pollen from an anther to the stigma.

Pollution human-caused change in the physical, chemical, or biological conditions of the environment that creates an undesirable effect on living things.

Population all the species that live in an area and make up a breeding group.

Precipitation water reaching the surface of the Earth (rain, sleet, snow, frost, and dew).

Predation an interaction where one species consumes another.

Predator an organism that feeds off of other organisms.

Prescribed fire the controlled application of fire to wildland fuels in either a natural or modified state, under specified environmental conditions which allow the fire to be confined to a predetermined area and at the same time produce the intensity required to attain planned resource management objectives.

Prescription is a written document detailing all site-specific information needed for a crew leader to successfully carry out a prescribed burn. It should include weather elements involved, fire behavior, smoke management, amount and type of fuel in the area, location of natural and manmade fire barriers, degree of risk and hazards present, burning technique and intensity of fire to be used, burning objectives for the particular area, restrictive measures dictated by law or local custom, fire suppression safety, location of any improvements which could be endangered, areas within the prescribed unit that may need to be excluded from fire.

Prey an organism that is consumed by another organism.

Primary consumers *see herbivore*.

Primary producers an organism that makes its own food through photosynthesis.

Producer organisms such as plants that make their own food.

R

Rainforest a dense, tropical forest where a lot of rain falls.

Rain shadow rain falls on the sides of mountains that face a water source rather than on the sheltered sides of mountains, creating a desert.

S

Sandy soil contains mostly sand.

Scavengers an animal that feeds on dead or decaying matter.

Secondary consumers *see carnivore*.

Sediment finely divided solid material that settles to the bottom of a liquid.

Soil the top layer of the Earth's surface, suitable for the growth of plant life.

Soil compaction is the process of increasing the density of soil by packing the particles closer together causing a reduction in the volume of air.

Stewardship the position, duties, or service of steward. In the National Park setting, stewards are people who help to preserve and conserve the National Park for future generations.

Stony soil contains many rocks.

Succession – the act of following in order.

T

Taiga the artic evergreen forest.

Tertiary consumers *see scavengers*.

Thermodynamics the relationship between heat and other forms of energy.

Tundra a cold area where there are no trees and the soil under the surface of the ground is permanently frozen.

U

Uncontrolled hunting unregulated hunting that reduces animal populations to a minimum.

W

Wadi a valley, gully, or riverbed that remains dry except during the rainy season.

Water cycle series of movements of water on and below the Earth's surface; includes storage, evaporation, precipitation and runoff.

Water infiltration rate rate of absorption and downward movement of water into the soil layer.

Weathering a process by which rocks exposed to the weather break down.

Wildfire an uncontrolled, rapidly spreading fire.

Ecology Resources

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